NATO Code of Best Practice (COBP) for C2 Assessment

Measures of Merit

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"It's best to know what you are looking for, before you look for it"

Winnie the Pooh, from A.A. Milne

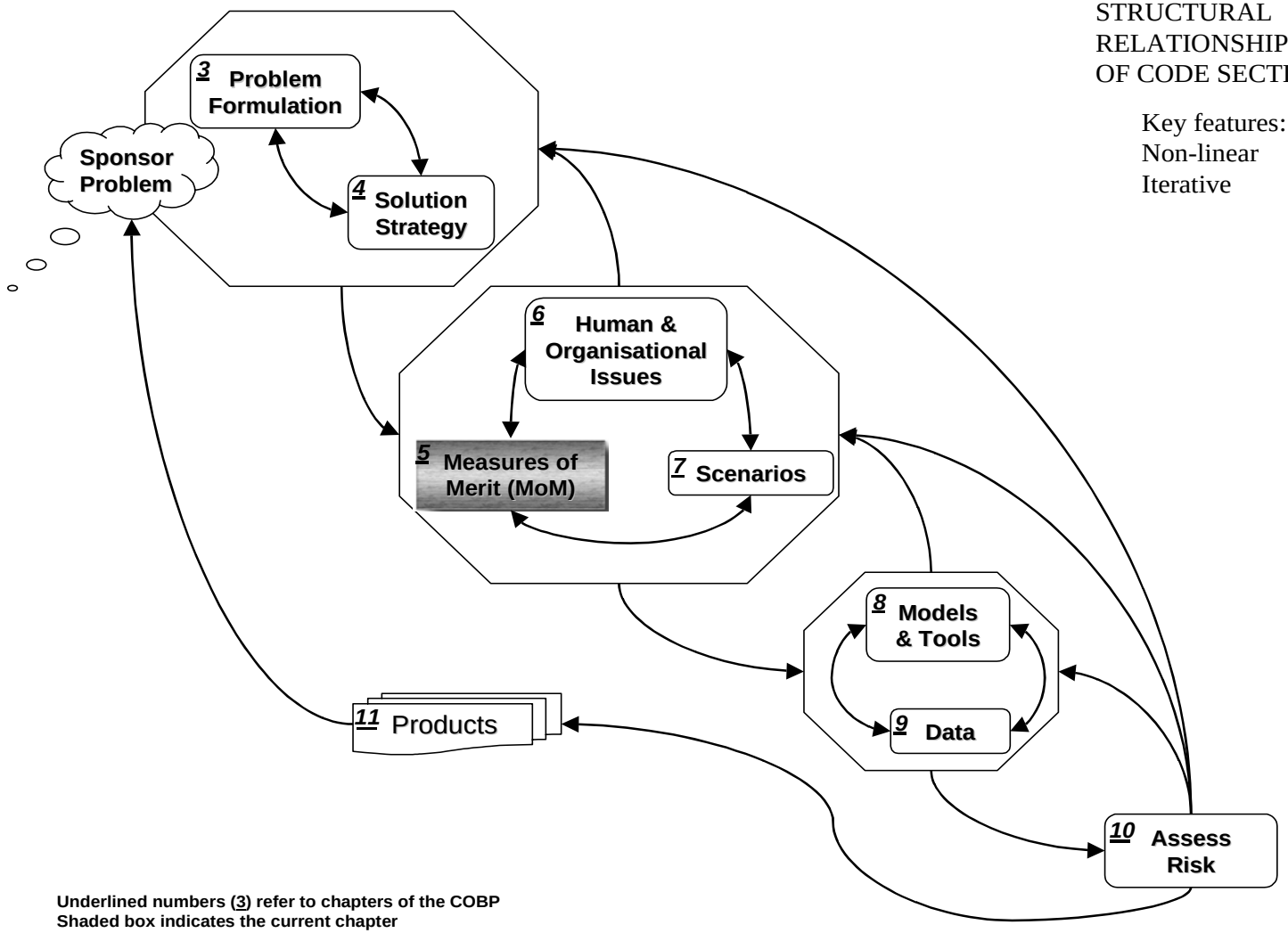
Overview

- Background
- Objectives
- Definitions
- Characteristics, Reliability, Validity
- Categories, Examples
- OOTW – Normality Indicators
- Collaboration Metrics
- Uncertainties
- Framework - Practical Issues
- Challenges / Issues
- Recommendations
- Conclusions

Context

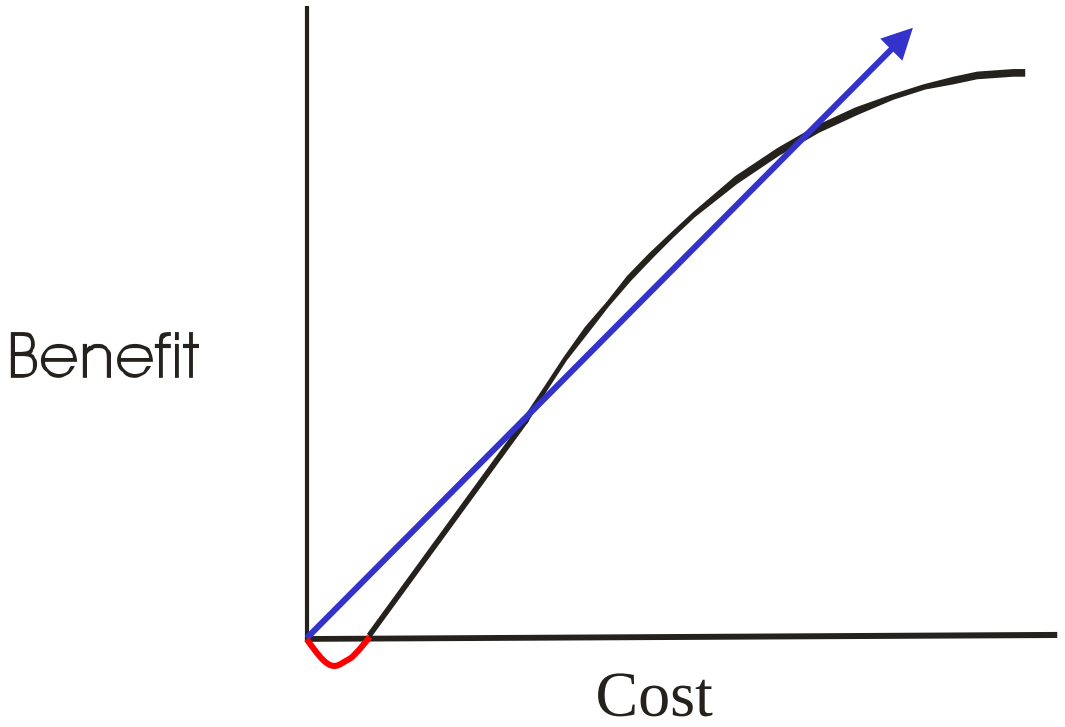
STRUCTURAL
RELATIONSHIPS
OF CODE SECTIONS

Key features:
Non-linear
Iterative



Underlined numbers (3) refer to chapters of the COBP
Shaded box indicates the current chapter

Background



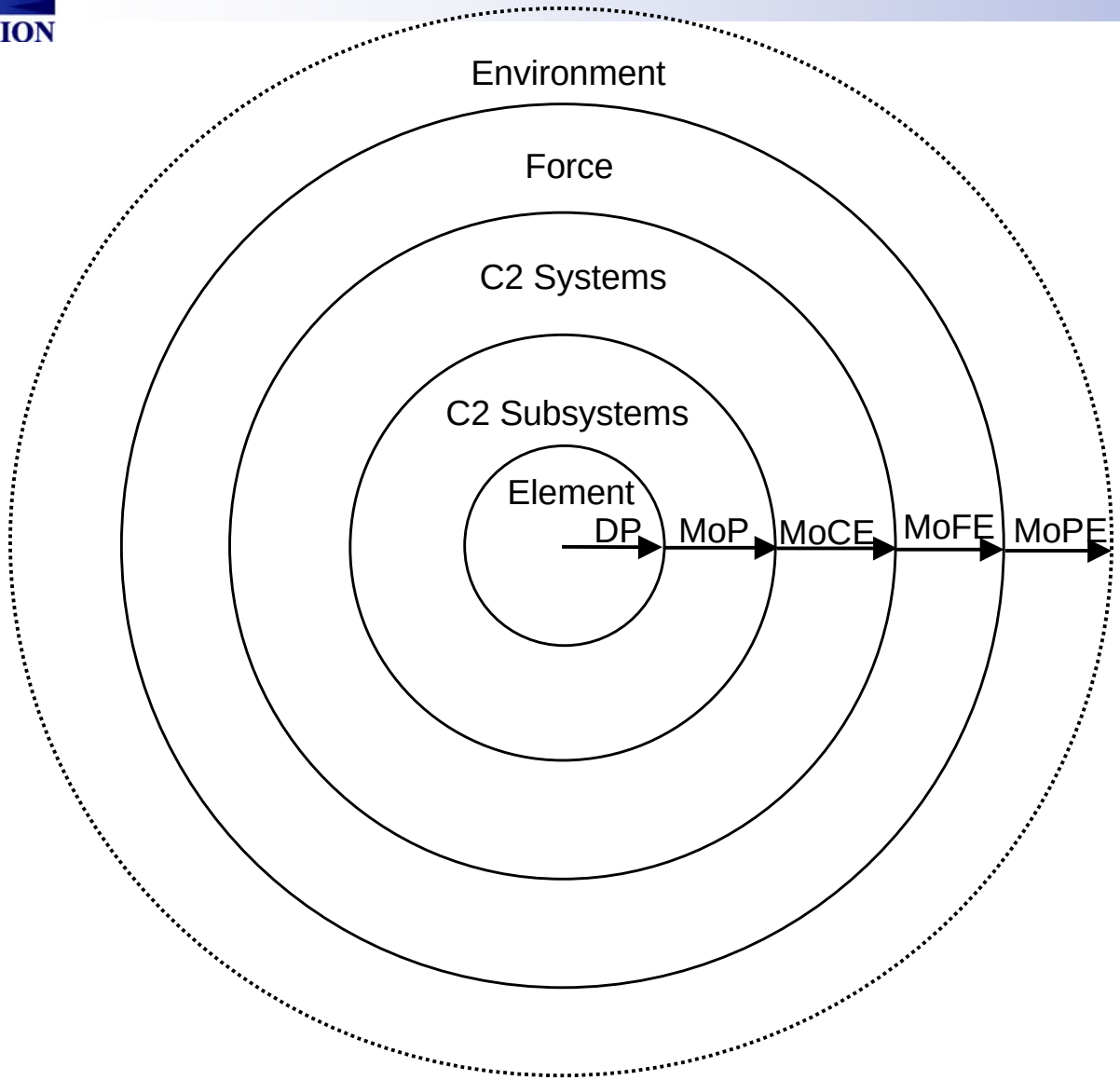
Objectives of Assessment

- Comparison of alternate systems or solutions
  - replacement systems or components
  - determination of most cost-effective approaches
  - assessment in new or unexpected applications
- Establishment of standards, bounds of performance
- Identification of potential weaknesses
- Analysis of effectiveness of training
- Evaluation of effectiveness of human decision making
- Assistance in requirements generation and validation

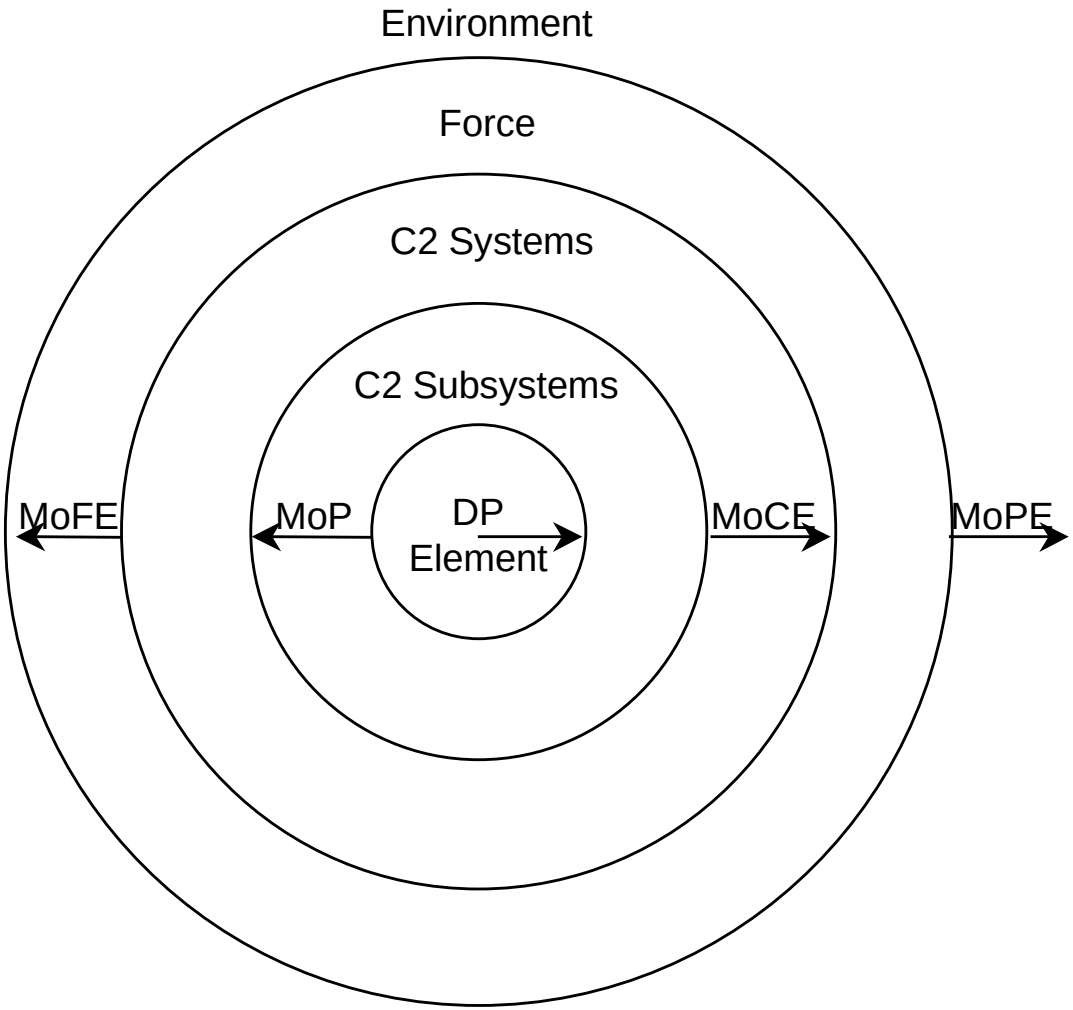
MoM Definitions

- DP - Dimensional Parameters
  - Properties or characteristics in physical entities
- MoP - Measures of Performance
  - Measures of attributes of internal system behaviour
- MoCE - Measures of C2 Effectiveness
  - Measures impact of C2 systems
- MoFE - Measures of Force Effectiveness
  - Measures of how a force meets mission objectives
- MoPE – Measures of Policy Effectiveness

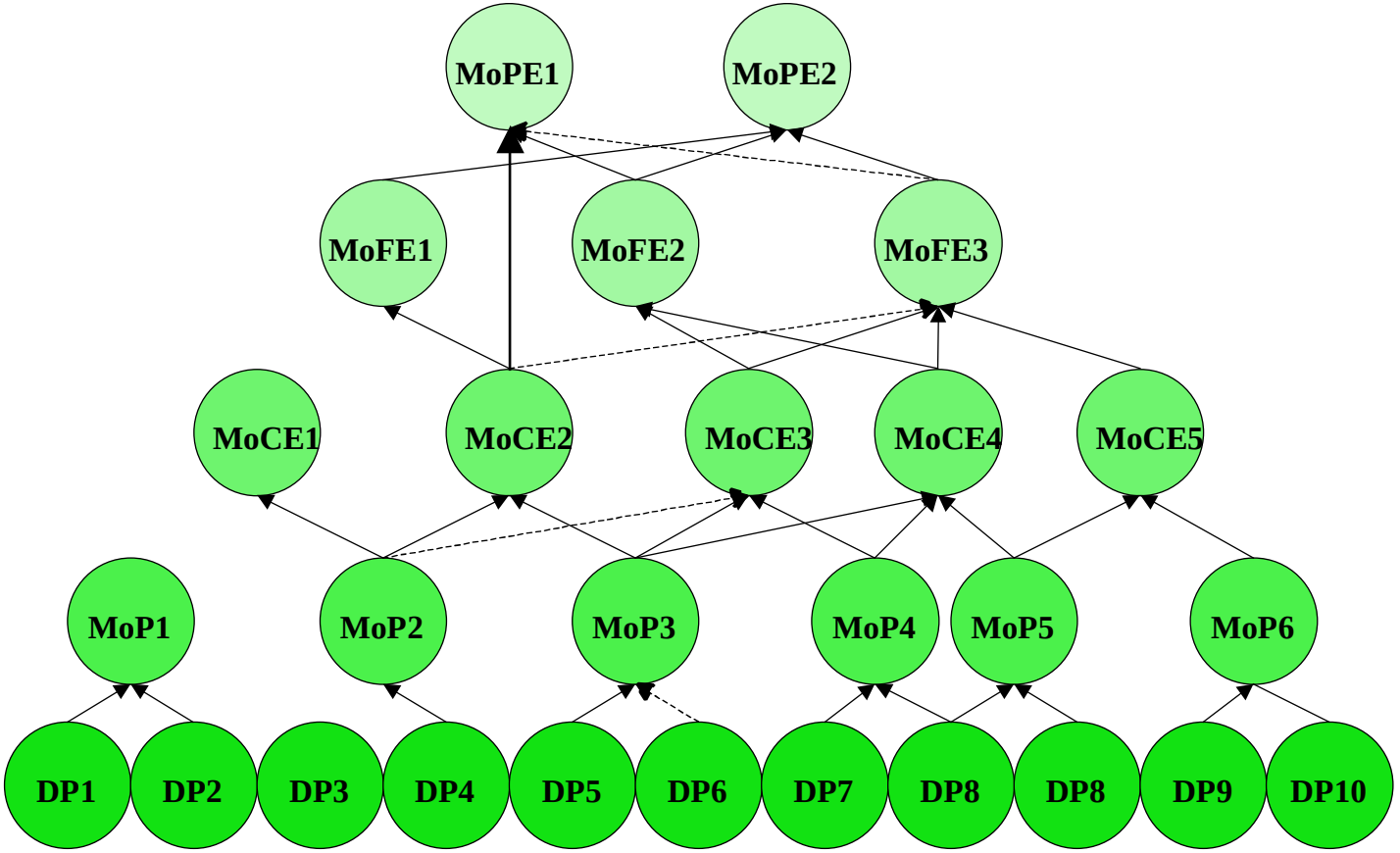
MoM Hierarchy



MoM Hierarchy



Linked MoMs


MoPE1
MoPE2
MoFE1
MoFE2
MoFE3
MoCE1
MoCE2
MoCE3
MoCE4
MoCE5
MoP1
MoP2
MoP3
MoP4
MoP5
MoP6
DP1
DP2
DP3
DP4
DP5
DP6
DP7
DP8
DP8
DP9
DP10

MoM Tendencies

MoM	Focus	Scenario	Effort Required	Number	Impact	Compre-hension	Generaliz-ability
MoPE	Outcome	Dependent	High	Few	High	Policy	Low
MoFE	Mission	↕	↕	↕	↕	↕	↕
MoCE	C3I						
MoP	Systems						
DP	Process	Independent	Low	Many	Limited	Technical	High

Characteristics of Measures (1)

- Reliability
  - accuracy of a measurement: variance of repeated measurements of the same phenomenon
  - must be known or estimated to discriminate between real effects and measurement effects

Characteristics of Measures (2)

- Validity
  - internal: causal relationship between variables
  - construct: measure objective, and only objective
  - statistical conclusion: results are robust with sufficient sensitivity
  - external: extent to which results could be generalized
  - expert: degree accepted by experts in the field

Levels of Evaluation

- Goals (mission objectives) - Environment
- Functions and sub functions
- Tasks
- Structure / Interfaces
- Physical Entities

Example HQ MoMs - Levels

- Network of headquarters
- Single headquarters
- Cells within the HQ
- Specific tasks within cells

Example HQ MoMs

- Monitoring and understanding
  - Information transmission, values, times, effect, comprehension
- Planning
  - Information exchange, co-ordination, impact, flexibility, process quality
- Directing and disseminating

Categories of Performance Measures

- Time based
  - time to perform a task
  - rate of performing tasks
  - time to react to events
- Accuracy based
  - precision of performance
  - reliability of performance
  - completeness
  - error rates
  - quality of decisions

Collaboration Metrics

- Averages of understanding among team members
- Extent of alignment of these understandings
- Maximum level of understanding within team
- Gaps in understanding throughout team

Normality Indicators

- Relative measures
- State of normalcy
- Characterize an element of the civil environment
- Data collected on a regular basis
- Assessment of the changes occurring in the civilian populace

Normality Indicators

Criterion	Examples
Political	Elections, political participation
Economic	Unemployment, interest rates, and market baskets
Social	Number of students in schools, number of refugees
Technological	Telephone system availability
Legal	Judicial system functioning
Environmental	Roads, water supply, power supply
Cultural	Sports events, concerts

Limitations of Normality Indicators

- Inexperienced personnel
- Limited resources, constraints
- Effect of military presence
- Require data to be calibrated against baselines
- Extrapolation across space and time
- Shifting emphasis, thresholds

Effects of Uncertainty

- Study assumptions
  - uncertainties in scenario, model input
- Modelling assumptions
  - Uncertainties in the model, structural uncertainty
- Model sensitivity
  - Uncertainties in the outcome

Summary : Framework

- Establish evaluation environment
- Define evaluation goals
- State context, assumptions, constraints
- Define domain – MoPE, MoFE, MoCE, MoP, DP
- Identify specific measures
- Establish scenario or stimulus
- Establish data collection means
- Pilot test, revise measures and procedures
- Conduct the tests, debrief and analyze

SAS-039 R&T ORGANIZATION

Challenges / Issues

- Linkage of DP-MoP-MoCE-MoFE
- Interpretation of measures
- Environmental components
- Reliability and validity
- Uncertainties - scenario, model, outcomes
- Human-in-the-loop
- Cost and convenience
- Modelling

Recommendations

- Plan with clear objectives
- State assumptions, constraints
- Formally assess reliability and validity
- Concentrate on MoCE and MoP
- Incorporate MoM data gathering into system design
- Include Subject Matter Experts in assessments
- Retain data as benchmarks for future comparison

Concluding Remarks

- No single measure or methodology exists for assessing overall effectiveness of C&C
- A multi-method, multi-phase approach is necessary

Measures of Merit (MoM)

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